

REMARKS

Support for the amendments to claims 8, 14 and 16 can be found, for example, on the first sentence of the specification; on page 9 at lines 25-28 of the specification and the examples. . No new matter has been added.

Rejections under 35 U.S.C. §112

The rejections under 35 USC §112 are moot in light of the amendment to claim 6.

Rejections under 35 U.S.C. §103

Claims 14 and 16 stand rejected as allegedly being obvious over Yamazaki (US 6,133,119) in view of Ichinose (US 5,688,366), Skorupski et al (US2002/0162218) and Klien (DE10101926).

Claims 2-4, 6-8, 10-12, 19-24 and 26-28 stand rejected as allegedly being obvious over Skorupski et al (US2002/0162218) in view of Klien (DE10101923) and Yamazaki (US 6,133,119).

Claim 25 stands rejected as allegedly being obvious over Skorupski et al in view of Klien, Yamazaki and further in view of Ohlsen (US 6,641,948).

None of the references teach or suggest a printable thickened etching paste having from 10-90 % by weight of a solvent which is a mixture of water and at least one other solvent. As previously discussed, Applicants have discovered that significant drawbacks can be avoided, if water is used as a solvent together with a further organic solvent.

On page 16 of the Office Action the Examiner states " the features upon which applicant relies i.e., that the etchant provides selective etching of silicon surfaces) are not recited in the claims." Thus, in the interest of furthering prosecution the claims 8, 14 and 16 have been amended to recite selective etching of a silicon surface or layer to a depth of 1-3 μm .

Yamazaki (US 6,133,119) is concerned with increasing the roughness of a silicon surface and thus, the depth of etching is not an important consideration. A 2% NaOH aqueous solution is applied over the surface. See col. 11, lines 55-64. The medium is aqueous and not thickened. Yamazaki only discloses a method and a liquid composition for roughening a silicon surface to form uneven textures. An aim of the present invention is primarily to remove selective material from the treated silicon surface and to get even surfaces. Yamazaki discloses a treatment with 2% NaOH aqueous -but not thickened- solution at 80 °C. The etching takes place for 5 min and a roughness of about 0.1 to 5 µm is achieved (see column 11, lines 44 - 64).

As can be seen in the the attached declaration under 37 CFR 1.312, the compositions of Yamazaki can not acheive etching depths of 1-3 µm. Rather a depth of only .02 µm is achieved. This invention achieves depths of 1- 3 µm. In no way can Yamazaki suggest this invention.

Moreover, any subsequent metal deposition will not be optimal and the circuit lines cannot be carried out properly. In comparison to this, the compositions of the present application are printable in very even lines. Additionally, the compositions of the present application lead to homogeneous etching results with the effect that the depth of the etched lines is homogeneous and nearly even surfaces are achieved. This is very important for the subsequent deposition of metallic circuits into the etched lines.

Thus, a skilled worker would not look toward the teaching of Yamazaki, which teaches a surface roughening composition for guidance on a composition that is capable of selectively etching fine even lines with depths of 1-3 µm.

A skilled worker would recognize that an etchant must be adapted to the surface which it will etch and would not look to Ichinose et al. (US 5,688,366) for guidance on etching silicon to overcome the deficiencies

of Yamazaki. Ichinose etches transparent conductive film (SnO_2 , InO_3 , ITO) with a solution that is mixed together with fine resin particles to form a paste. All examples use acidic etching compositions (concentrated sulfuric acid, concentrated hydrochloric acid or ferric chloride) and the liquids are thickened with macromolecular resin particles. Particulates can not be applied homogeneously to the surface to be etched and result in a very irregular etching profile. In contrast, the compositions of the present application lead to homogeneous etching results with the effect that the depth of the etched lines is homogeneous and nearly even surfaces are achieved. Furthermore, as discussed in the declaration submitted herewith, the compositions of Ichinose only achieved etching depths of 0.1- 0.13 μm . This invention achieved depths of 1-3 μm .

Ichinose offers no way to overcome the deficiencies of Yamazaki. Ichinose is silent regarding the etching of silicon surfaces such as those used by Yamazaki and employs an acid etchant with a completely different reactive chemistry from that of Yamazaki.

Thus, a skilled worker would not have combined the teaching of Yamazaki with Ichinose. Neither reference teaches or suggests an etching medium that is printable according to the present invention, particularly suitable for the selective etching of fine lines to depths of 1-3 μm . Nor do they teach or suggest compositions comprising a mixture of solvents (i.e., water and at least one of the different organic solvents) for achieving this purpose. Therefore, the combined teachings do not meet all of the elements of the claimed invention.

Skorupski (US 2002/0162218) teaches the manufacture of printed circuit boards having improved interlayer adhesion. Skorupski teaches a skilled worker how to generally roughen the surfaces of metal foils and not silicon surfaces. The physical properties of silicon and polyimide are entirely different and a skilled worker would not look to an etchant for polyimide to etch silicon. See Example 27. The Examiner relies upon

Skorupski for teaching NaOH etching mediums possessing between 8 and 16%wt NaOH. Substrates are chemically etched by running them through a solution (see Example 7). The etching mediums of Skorupski roughen the substrate surfaces in order to achieve a better adhesion of interlayers.

Like Yamazaki, Skorupski does not teach or suggest a mixture of solvents (i.e., water and at least one other organic solvent). Moreover, like Yamazaki, the etching mediums of Skorupski are not printable and do not provide selective etching to a depth of 1-3 μm . As can be seen in the attached declaration, even at elevated temperatures the composition of Skorupski resulted in very weak etching depths of 0.3 μm . Furthermore, the compositions of Skorupski do not result in enhanced silicon edge isolation. Thus, unlike the present invention, any subsequent metal deposition will not be optimal and the circuit lines cannot be carried out properly. As noted above, a homogeneous and even depth of etch is very important for the subsequent deposition of metallic circuits into the etched lines.

Even if a skilled worker were to use the NaOH etchant of Yamazaki and Skorupski in a thickened form they would still not achieve selective etching. Klein (DE10101926) is relied upon for teaching the addition of a thickener for making an etching solution a paste (see page 4 of English translation). Klein does not cure the deficiencies of the above discussed references. Klein uses fluoride based etchants (e.g., fluoride, bifluoride or tetrafluoroborate as etchants) optionally in combination with mineral acids and/or organic acids. In addition, Klein's compositions contain a buffer like lactat or H_3PO_4 . On page 3 of the translation, Klein broadly teaches a laundry list of 36 specific suitable solvents and numerous classes of solvents and states that they may be mixtures. There is nothing which would lead a skilled worker to choose from among 36 specific solvents or any of the hundreds of possible solvents from among the classes of solvents to arrive at a mixture of water with another solvent. As noted in the attached declaration, Klein only achieves an

etching depth of 0.12 μm . Klien does not teach or suggest the selective etching of silicon surfaces to a depth of 1-3 μm . A skilled worker would not look to Klien to modify the teachings of the other references because Klien discloses etching solutions for entirely different surface chemistries with entirely different active ingredients. These surfaces have active ingredients that are also different from the surfaces of the present invention.

As can be seen, each of the four above-mentioned references alone and in combination fails to suggest the claimed subject matter. Had there been a prima facie case of obviousness the data on the attached declaration demonstrating unexpected results for this invention over the references clearly refutes the same.

Ohlsen (US 6,641,948) discloses the application of a photoresist layer to protect areas from the subsequent application of an aqueous 30 % KOH solution. Ohlsen is silent regarding a printable etching paste. As noted above, an aqueous etching solution is not comparable with the printable compositions of the present application. Ohlsen does not cure the deficiencies of Skorupski or the other references. None of the references teach or suggest a printable thickened etching paste having a mixture of solvents comprising water and at least one other organic solvent. Furthermore, they are silent regarding exposure times and do not achieve the recited line depths.

Since the method of the present application is carried out using a thickened composition, the diffusion mechanism of the etchant in a thickened, thixotropic solution is entirely different from that in a liquid composition, not only are the etching results entirely different but in order to achieve good results the activating temperature has to be different as well. Furthermore, the etching process consumes significantly reduced amount of etching chemicals since the etching paste is only applied to the areas to be etched.

Based on the above remarks it is respectfully requested that the rejection under 35 U.S.C. §103 be withdrawn.

No fee is believed to be due with this response, however, the Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

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Attorney Docket No.: **Merck-2976**
Resubmitted Date: **2 October 2009**